Why Islamic Banks Are Relatively More Resilient to Crisis?

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The financial crisis repeatedly struck various countries in the world in rotation, both developing and developed countries. In fact, in the modern economic period like now, the intensity is becoming more frequent and acute. Therefore, an early crisis detection system becomes important to avoid the more severe negative impact of the crisis. This study tries to examine what indicators can be used as a reference in predicting how likely there will be a crisis in a dual banking country such as Indonesia by using the binary logistic regression method. The results show interesting important conclusions. First, Islamic banks tend to have problems with liquidity (with significant FAR evidence) while conventional banks tend to have problems with solvency (significant CAR). From this, it follows that the Islamic bank will only be in crisis if the real sector is disrupted. While conventional banks will always flare up if there is a disruption of the financial crisis. Second, related to the significant M2RES variable, both in the Islamic and conventional models, this could be a result of the enactment of fiat money and fractional reserve banking system (FRBS). Though both of these are contributors to excess money supply which is quite large. So it becomes reasonable to understand if both models - both Islamic and conventional - have similar conditions. As a consequence, the Islamic banking entity is not going to be free from the adverse effects of the financial crisis. The third conclusion that is no less important is departing from the fact that the interest rate (INTR) turns out to be significant in the conventional model but not if it is in the sharia model, it can be concluded that a policy rate such as the BI-rate is very effective at controlling and influencing instruments Other monetary policies follow also the behavior of conventional banks. But on the other hand, this also indicates that conventional banking is indeed quite vulnerable to monetary shocks and financial crises. Thus, it becomes a rational reason for monetary authorities, in this case, Bank Indonesia to provide more support to the sustainability of Islamic finance and banking in Indonesia to achieve stable and optimal monetary conditions.

Keywords: Early Warning System; Banking Crisis; Double Monetary System; Logistics Regression

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INTRODUCTION

The financial crisis has repeatedly hit various countries in the world in turn, both developing and developed countries. According to Luc Leaven and Valencia (2008) during the period from 1970 to 2007, there were 429 crises which were divided into 124 banking crises, 208 exchange rate crises, 63 foreign debt crises, 26 twin crises, and 8 triple crises. Meanwhile, Boyd et. al (2009) classifies crises according to each country based on the research of Kunt and Detragiache (2005); Caprio et. al (2005); Reinhart and Rogoff (2008); Laeven and Valencia (2008).

The crisis phenomenon in Indonesia which had a significant impact was the one that occurred during the 1997-1998 monetary crisis. Among the impacts on the banking industry was the closure of 16 banks after a massive rush by the bank's customers, resulting in the loss of liquidity. Likewise with inflation that jumped to 77.6%, economic growth that fell to -13.2% (Hatta in Ascaraya, 2008) and the depreciation of the rupiah exchange rate which reached Rp.10,000 / US dollar led to a banking crisis due to bankruptcy of several banks. private companies that fail to pay their loans in foreign currency (US Dollar). The 1997 financial crisis hit several other Asian countries, including: Thailand, Malaysia, Singapore, the Philippines, South Korea. This crisis does not extend to other parts of the world.

Meanwhile, the crisis that occurred in 2007-2008 started in America. Unlike the 1997 financial crisis which had local impacts, the 2008 crisis spread to almost all parts of the world. The stock market fell. Multinational financial companies went bankrupt. Many companies in the US are reducing workers. Due to the financial crisis in the US, portfolio investors on the stock market withdrew their funds. As a result, the stock market fell and now the exchange rate of Asian currencies has also fallen. The rupiah exchange rate against the dollar once reached the level of Rp. 12,650 per US dollar on 24 November 2008. Likewise, the JCI, in the same period experienced a depreciation of 42%.

However, the decline in the rupiah exchange rate is sometimes only interpreted by the majority of people in Indonesia to the extent that they are forced to postpone the purchase of goods that have soared in price. The increase in the prices of these goods also triggered the inflation rate to touch 12.56% in 2008.

Kaminsky et al. (2000) stated that there was no sudden crisis. The threat of a future crisis can be detected by looking at the movement of economic indicators such as the balance of payments position, economic growth, exchange rate inflation, interest rates, and the money supply. The crisis in the banking sector is related directly or indirectly to various activities commonly carried out by the banking industry. Therefore, in general, problems that arise in the banking industry can come from both internal and external sides. On the internal side, problems can be seen from the development of the performance of each bank as a whole. Meanwhile, macroeconomic conditions and developments in industry performance financed by bank credit can serve as indicators of disturbances from external factors.

Based on the 2008 Bank Indonesia Annual Report, various indicators for commercial banks were relatively good, accompanied by credit expansion that was able to support the domestic economic activity which was growing quite rapidly. Capital adequacy was maintained despite a slight decline due to high credit expansion. It turns out that high credit growth is not accompanied by growth in deposits, which creates liquidity risk in several banks, although in terms of system liquidity remains sufficient. The speed of credit growth of 29.5% was not matched by the growth rate in deposits which grew by 16.1%. This condition causes a shortage of funds, thus reducing bank liquidity.

Meanwhile, the performance of Islamic banking was relatively unaffected by the impact of the global crisis, so that the intermediary function was running optimally with a relatively low level of non-performing financing and always supported the real sector's financing. Asset and funding growth was also recorded quite high. In addition, the exposure to Islamic bank financing, which was still dominated by financing for domestic economic activities, also played a role in strengthening the resilience of Islamic banks from the impact of the global financial crisis.

However, in semester II of 2008, the growth rate of assets, deposits and financing disbursed experienced a slowdown as a result of the decline in bank liquidity conditions and slowing activity in the real sector, which began to be affected by the global financial crisis. However, the distribution of financing by Islamic banking continued to grow high, not affected by the global financial crisis. This is because the character of financing must be based on real transactions, so that this can confirm the increasing contribution of Islamic banking in financing the real sector.

Considering that the impact arising from the crisis is very broad, which is also caused by the unpreparedness of a country in facing the crisis from the start and the possibility of a crisis and evidence of the absence of a sudden crisis, it is necessary to have a crisis early warning system. Since then, many economists have conducted research in various parts of the world to create an Early Warning System (EWS) model using various methods deemed suitable for their research. This is done with the aim of being able to anticipate the arrival of the crisis early so that a country can prepare various policies to reduce the impact of the crisis.

However, unfortunately only a few have conducted studies specifically for the Indonesian state. Most of these studies used regional samples or specific countries. Indonesia, which has implemented a dual banking system since 1998, has motivated researchers to...
compare the object of this study in two types of banking, namely conventional and sharia. Thus, the author tries to examine what indicators can be used as a reference in predicting how likely a crisis will occur which is classified into two: Conventional Banks and Islamic Banks.

Seeing the crisis phenomenon which has a very broad impact on the Indonesian economy, this study formulates problems related to the factors that are indicators of a banking crisis, both in the Islamic and Conventional Banking Industry. In particular, this study tries to answer:

1. What factors can be used as early indicators of the financial crisis for the conventional banking industry?
2. What factors can be used as early indicators of the financial crisis for the Islamic banking industry?
3. Which banking industry has better resilience in facing crises?

Research Objectives

This research is expected to provide benefits, including:

1. Can be used as consideration for players in the Islamic and conventional banking industry, macro indicators that can be used as initial information on potential banking crises so that preventive measures can be taken to reduce the impact of the crisis itself.
2. Can be used as material for consideration for practitioners related to Islamic banking in particular to formulate appropriate strategies that can be applied in order to minimize the impact of the banking crisis in maintaining the stability of Islamic banking.
3. This research is also expected to be used as a reference for further studies relating to early indicators of a banking crisis, especially for Islamic banking.

LITERATURE REVIEW

Financial Crisis Theory

The financial crisis is a condition in which various control measures are no longer able to withstand turmoil in the financial sector, which will soon be followed by an overall economic contraction (Prasetyantoko, 2008). Kaminsky et.al (1997) defines a crisis as a situation in which an attack on the exchange rate system causes a sharp depression in the exchange rate, or it can result in a drastic reduction in foreign reserves or even a combination of the two.

In general, economic crises can be caused by one or a combination of several types of crises such as banking crises, exchange rate crises, foreign debt crises, balance of payments crises, financial crises, monetary crises, stock market crashes, bubble economy, and hyperinflation. Economic crises can trigger or be triggered by political crises and social crises. An economic crisis can cause an economic reaction which will ultimately lead to stagnation, recession, depression, unemployment, losses, hunger, death (Ascarya, 2008).

Crisis In Conventional Perspective

In a conventional perspective, financial crises are divided into four types, namely exchange rate crises, banking crises, foreign debt crises and stock market crashes. However, in reality, these crises can occur simultaneously two or three types at once.

1. Currency Crisis

Exchange rate crisis or balance of payment crisis (BOP) is often defined as an event of a depreciation of the exchange rate of a country's currency against a foreign currency, usually the US Dollar, a decrease in foreign reserves (foreign reserve), and an increase in short-term interest rates. (short-term interest rate) that is not reasonable (Goldstein et. al, 2000).

2. Banking Crisis

Banking crises are defined through two approaches, namely indicators-based and events-based. Several indicator-based instruments are non-performing loan ratios (NPL ratios), bank rescue operating costs, and bank capital losses. Meanwhile, events-based view the crisis from the occurrence of massive withdrawals of deposits by customers (rush), bank closings, mergers of several banks (mergers), and takeovers by the Government or take over by large banks, and government intervention in the financial sector (Hadad, et al, 2008).

Kunt and Detragiache (1998) define a crisis as a condition in which one of the following conditions is met:

a) Non-performing assets reach 10% of the total assets of the banking system;

b) The cost of saving the banking system is 2% of GDP;

c) There was a transfer of ownership of banks on a large scale to the government; and

d) There has been a widespread “bank-run” or there have been emergency measures taken by the government in the form of freezing public savings, closing bank offices for a fairly long period of time, or implementing comprehensive deposit insurance.

Banking crises also tend to arise when macroeconomic conditions deteriorate. In this case, low GDP growth is closely related to increased risk in the banking industry. In addition, the increased risk in the banking industry can also come from high inflation rates and efforts to stabilize the inflation rate will result in a sharp increase in real interest rates which in turn increases the likelihood of a banking crisis (Hadad, et al, 2008).

3. Sovereign Debt Default
Foreign debt crises usually occur because the country fails to pay its debts to other countries (bilateral debt) or international institutions (multilateral debt). This foreign debt crisis is usually followed by rescheduling of debt payments. An example of this crisis is the debt crisis in Poland in 1980 and in Mexico in 1982 (Ascarya, 2008). Recently, the foreign debt crisis has hit America and Europe.

4. Stock / Asset Market Crash

Stock / Asset Market Crash occurs when the price of a stock or other financial asset is drastically overvalued in a short time (Ascarya, 2008). Leaven and Valencia (2008) state that the aforementioned crises can also occur simultaneously. When a banking crisis and an exchange rate crisis occur simultaneously or trigger each other, it is called a twin crisis. Meanwhile, if a banking crisis, exchange rate crisis and foreign debt crisis occur simultaneously and trigger each other, it is called a triple crisis. The financial crisis in Indonesia that occurred in 1997 is an example of a triple crisis because it is a combination of an exchange rate crisis, banking crisis, stock market crash, followed by a foreign debt crisis in 1999 (Ascarya, 2009).

Financial Crisis in Islamic Perspective

The occurrence of a crisis in Islam is inseparable from economic practices or activities carried out against Islamic values such as the act of consuming usury, monopoly, corruption, and other actions prohibited by Allah. This is as stated by Allah SWT in Surah Ar-Rum ayah 41 below:

"It has appeared that the damage on land and at sea has been caused by the deeds of human hands, so that Allah will feel for them a part of (the result) of their actions, so that they will return (to the right path)". (Surah Ar-Rum: 41)

Conducting economic practices that are contrary to Islamic law is an action that is not only detrimental to oneself but also damages the joints of the economic life of the ummah. Violation of Islamic law will invite direct or indirect calamity from Allah SWT. The economic crisis is one example of a catastrophe or test of Allah SWT on His creatures who have carried out economic activities too far from the teachings of the Koran and Sunnah as well as legalizing rampant usury prevailing in society.

According to Islamic economists, the main cause of the crisis is the imbalance of the monetary (financial) sector and the real sector. The financial sector is growing rapidly and leaving the real sector far away. The removal of the monetary sector from the real sector is evident in the virtual transaction business through derivative transactions that are full of usury. Virtual transactions on the stock exchange and the capital market account for more than 95 percent of all world transactions. Meanwhile, transactions in the real sector in the form of trade in goods and services are only around five percent. In Islamic economics, the amount of money in circulation is as much as the value of goods and services. In other words, the source of the world's economic catastrophe is the practice of Maisir, Gharar and Riba which are forbidden. Maisir in the form of gambling and speculation. Gharar is a virtual transaction, a high-risk business. Riba is a search for profit without real business transactions.

According to Ascarya (2009), the main root cause of the crisis is the economic system used by a country which lies in the misuse of economic concepts triggered by the failure of economic human behavior who are greed, consumptive (consumerism) and seek pleasure (hedonism). The crises that occur predominantly stem from the chaos in the financial sector. This is an accumulation of misconceptions (economic systems) and human behavior. The interaction between the two has resulted in the creation of crises that regularly hit the world economy.

Therefore, there are several things that are the main roots of the crisis in the Islamic perspective put forward by Ascarya (2009), including:

1. Excess Money Supply

Excess money supply can be caused by excessive money creation and artificial purchasing power. Excessive money creation can be through the printing of currency (seigniorage) and the creation of demand deposits / bank money (money multiplier), while the creation of pseudo purchasing power can be through credit cards. Excess money supply is proven to be one of the main determinants of inflation in almost all countries, including Indonesia (Ascarya, 2008).

Banks with fractional reserve banking system can actually create money many times over without the need for assets to back it up. Credit cards are basically as a means of creating instant purchasing power for the holder. With the various conveniences of a credit card, credit card debt is getting higher and swells fast. In the end, bad credit from this credit card triggered a crisis.

2. Speculation

Ascarya (2009) states that speculation is essentially a zero-sum game that encourages risk shifting behavior which does not produce real added value which is different from risk sharing in real sector investment activities that can generate real added value. Speculation in the capital market and money market occurs when investors expect instantaneous gains from capital gains, short-selling, misuse of hedging, derivatives, and the like. Speculation is a zero - sum game (you lose what I gain) so that there is no added value in the economy, such as that generated in trade or business activities based on risk sharing.

Speculators actually realize that the capital gains that can be achieved in speculative transactions will not be achieved in the short term and realize that the interest cost on their loans will increase. In the end, a further consequence is the endless cycle of asset sales, asset price drops and bank closings. Speculators who make quick money may like the ups and downs that
have affected the economy and short-term projects that have sometimes benefited owners of funds who ask for collateral and have liquidity. However, this type of activity does not really encourage the formation of an industry that is able to provide job opportunities and stable value added in the long term (El-Diwany, 2005). This act of speculation is the main cause of the second generation crisis experienced by Mexico.

3. Riba (Interest)

Islam has forbidden usury to be practiced in the economic activities of its people. This also distinguishes between the Islamic economic system and the conventional economic system. The prohibition of usury is not done without unclear reasons. The reasons for the prohibition of usury are as follows:

a. The ribawi economic system has created injustice in society, especially for capital providers (banks) who are sure to receive profits regardless of whether the borrowers of funds (customers) gain or lose. This is contrary to the principles of Islamic economics which uphold the value of justice. If the customer experiences a profit, then injustice may not occur, but if the customer's business experiences a loss and even goes bankrupt, the borrowers must pay back the borrowed capital plus the interest on the loan. This is a form of injustice for the community as customers.

b. The ribawi economic system also causes an imbalance between capital owners and borrowers. The large profits earned by borrowers who usually consist of giant industrial groups (conglomerates) are only required to pay their capital loans plus loan interest in relatively small amounts compared to the billions of profits they get. In fact, the depositors of money in banks generally consist of middle to lower class people. This means that the large profits received by conglomerates from the proceeds of their borrowed money are not worth the capital providers (depositors in banks) who generally consist of the middle to lower class society.

c. The ribawi economic system will inhibit investment because the higher the interest rate in society, the less likely people are to invest. The public will be more inclined to save their money in banks because of the greater profits obtained due to high interest rates.

The higher the interest rate, the more likely it is that investment flows will be stagnated. With the prohibition of usury, there is no wall that limits the flow of investment so that it flows smoothly without obstruction. This was clearly seen when Indonesia was hit by the financial and banking crisis in 1997-1998. At that time, bank interest rates soared very high, reaching 60%. With such high interest rates, it can be said that almost no one dares to borrow from a bank for investment (Ascarya, 2007).

In contrast to the Islamic economy, which offers the concept of profit loss sharing which is a ratio (percentage of profit sharing), the amount of which is determined at the beginning of a fixed transaction, but the nominal value of the rupiah is not known with certainty but looks at the profit and loss that will occur later. When the profit is obtained, the customer will pay the agreed percentage level for the results. When the conditions break even, there is no payment and when you experience a loss, the loss will be shared between the customer and the bank. This sharia system shows a situation where no party is treated unfairly. Risks which are uncertain conditions will come to be borne together and if you experience large profits, you will share them together according to mutual agreement at the beginning (Ascarya, 2007).

4. International Monetary System

The current international monetary system is based on the fiat money of each country whose value is floating freely and is not backed up by any real assets. Therefore, every country benefits from the printing of money (seigniorage) at the expense of all the people holding the money whose purchasing power continues to decline (inflation). Even more fortunate is a large country whose currency is the world trading currency, especially the American dollar. The United States enjoys enormous seigniorage from the use of its dollar bills at home and abroad. This situation causes persistent and unfair inflation, especially for small, poor countries, and their currencies are not convertible (Ascarya, 2009).

Financial Crisis Early Warning System

Early Warning System (EWS) is a model that is useful for predicting the chance and timing of a crisis. According to Kaminsky et al (1998), EWS is a model that aims to see various economic and financial indicators as a sign that a crisis will occur in a relatively short time, namely 18 months to 24 months.

There are several model approaches in determining the likelihood of a crisis occurring. The following is a model in determining a leading indicator model for the possibility of a financial crisis, namely: 1) Signal Approach

This model compares indicators during the pre-crisis period (tranquil) with the identified crisis period. These indicators are selected based on changes in indicator behavior between normal periods and crisis periods that show reliable crisis "signals". Goldstein et al (2000), approached the signal through five stages, namely; (1) determine the episode of the crisis, (2) choose a leading indicator as a predictor, (3) set the threshold value for the selected leading indicator, (4) construct a composite index, and (5) predict a crisis.

This model uses various indicators together to provide signals on the crisis period. Thus, sometimes the required data becomes too much so that it becomes a confounding factor if the indicator does not provide a
signal. All good indicators will be selected to determine the composite index.

This model was first developed by Kaminsky, Lizondo, and Reinhart (abbreviated as KRL, 1997 and 1998) which focuses on monitoring a number of indicators (15 indicators). In addition, Goldstein, Kaminsky, and Reinhart (GKR, 2000) also did it. Meanwhile, the cases in Indonesia were carried out by Imansyah and Abimanyu (2008), Florencia (2011) and Kemu (2005).

2) Econometric Approach

In the econometric approach, generally using a probit or logit model. This approach makes an estimate of the probability of a financial crisis using the discrete dependent variable in its econometric model. The logit or probit model uses qualitative dependent variables as discrete variables with values of 1 and 0. While the independent variables are non-discrete.

The advantage of this logit model compared to the signal model is that the calculation results of each variable directly contribute to the calculation of the probability of a financial crisis. Meanwhile, the weakness of this logit model is that it cannot capture all variable information. That is, the ability to provide signals for each variable cannot be seen in this model.

LITERATURE REVIEW

There have been many researches related to indicators of a crisis, especially a banking crisis. Some of these studies include, Kunt & Detragiache (1998), Shen & Hsienh (2003), Hadad et. al (2003), Ali (2007), Boyd et. al (2009), Barrel (2010), and Bucevskka (2011).

In a study entitled The Determinants of Banking Crises in Developing and Developed Countries, Kunt & Detragiache (1998) describes the factors that determine the occurrence of a banking crisis. These factors include macroeconomic factors (growth, changes in TOT (Term of Trade), depreciation, real interest rates, inflation rate, budget surplus to GDP), financial (M2 ratio to foreign exchange reserves, bank cash ratio and reserves to bank assets, credit growth) and institutional.

Chung-Hua Shen and Meng-Fen Hsienh (2003) in their research combined macro and micro approaches as a modification in the early warning system to monitor the possibility of banks being hit by a crisis. The results of the research are; (a) The strong micro indicators are non-interest expenses / total assets and ROA, while the micro indicators prone to banking failure are equity that exceeds total assets, (b) The NPL indicator which is typically believed to be useful as an indicator of bank failure is not informative for outsiders. (c) Macro indicators that can be used as strong indicators are the GDP growth rate and the Exchange Rate, while the weak indicators are bank credit and short-term external debt. In fact, M2 / FR did not contribute even though other studies stated that this indicator had an effect.

Meanwhile Hadad, Santoso, and Ariansa (2003) explain that there are at least six indicators to see the potential for a banking crisis, including: slowing real GDP, slowing private consumption, lowering the level of investment, sharp depreciation in the exchange rate, providing credit to the sector. intensive private sector activity, and a sustainable reduction in the amount of savings.

Barrel, Davis, Karim, and Liadze (2010) in their research in 2007 concluded; (a) Banking CAR, Banking Liquidity and Property prices have a significant impact in determining the probability of a banking crisis occurring and these variables are more traditional than GDP Growth, Inflation, and Real Interest Rate. Therefore, this model can be used to detect the possibility of a banking crisis, (b) A high CAR accompanied by a liquidity ratio is able to indicate the possibility of a banking crisis, which has long-term implications for covering losses from costs determined by regulations.

Meanwhile, Vesna Bucevskka (2011) produced a study with the following conclusions; (a) DEBT, LOANS, and DEPOSITS are the three main indicators of Early Warning System in predicting financial crises in Croatia, Macedonia and Turkey. In addition, REER, Current Account Deficit, Fiscal Deficit, and PORTFOLICHANGE are statistically very significant in the financial crisis in European Union countries. (b) EU countries must reduce their foreign debt related to GNP and continuously analyze and closely monitor the financial processes in their countries in anticipation of a similar crisis.

Another research was conducted by Ascarya (2009) with the title Lessons Learned from Repeated Financial Crises: An Islamic Economic Perspective. This study compares the contribution of the conventional monetary system (fiat money, fractional reserves banking system, and interest) with the Islamic monetary system (gold money, 100% reserves banking system, and PLS). By using the VAR / VECM methodology, the dependent variable used is inflation (INF). The results of this study indicate that the conventional monetary system contributed greatly to the crisis by 66.6% (2.8% excess money supply; 45.2% interest rate; and 18.6% exchange rate). Meanwhile, the Islamic monetary system only contributed 3.4% to the crisis, namely 0.7% just money supply; PLS Return 2.5% and single global currency 0.2%. This shows that using the Islamic monetary system will be able to minimize the probability of a financial crisis in Indonesia.

Muhammad Handry Imansyah (2004) in his research concluded that the variables that are important to determine the likelihood of a crisis are Exports, real exchange rates, the ratio of fiscal deficit to GDP and world oil prices. The model he developed was able to predict the 1998 crisis and crises that would occur in the future, namely the mini crisis in 2005 and the crisis that occurred in 2008.
From the description above, it can be concluded that a crisis can be indicated by micro (banking) and macro (macroeconomic) factors. Kunt (1998), Shen (2003) Hadad et. al (2003), Boyd et. al (2009), and Barrel (2010) stated that the GDP growth factor is the most important macroeconomic indicator in indicating the possibility of a crisis. In addition, inflation, exchange rates, interest rates and investments can also be used as indicators of the possibility of a crisis. Meanwhile, the micro indicator is determined by credit disbursed by banks (Hadad, 2003; Ali, 2008; and Bucevka, 2011). Meanwhile, Kunt (1998) and Boyd et al (2009) stated that interest rates can cause banking crises to become systemic.

**RESEARCH METHOD**

**Types and Sources of Data**

The method used in this research is Binary Logistic Regression (Logit Model Regression) where the dependent variable is a categorical value (0 and 1). The data used in this study as a whole is secondary data taken from official sources in the form of months in the period January 2004 to April 2017. Islamic banking data is obtained from Bank Indonesia Islamic Banking Statistics (SBS-PI) and conventional banking data is obtained from the Indonesian Banking Statistics Bank Indonesia (SBI-BI). Meanwhile, macroeconomic data were obtained from the Indonesian Economic and Monetary Statistics, Bank Indonesia (SEKI-BI), the Central Statistics Agency (BPS) and International Financial Statistics (IFS).

**General Equations and Research Variables**

By using a logistic regression model, the general equation used in this study is made into four research equation models which are equations with one dependent variable and independent multivariable which can be written in Table 1 in Appendix.

In this study, the dependent variable is Crisis Severe Distress (CSD). The CSD value is obtained from the crisis category developed by Kaminsky, Lizardo, and Reinhart (KLR) which uses the EMP calculation weighting the REER growth rate, the difference in domestic interest rates over a span of one period, and the growth rate of the national foreign exchange reserves. Mathematically this equation can be written as follows:

\[ EMPI_{it} = \omega_{REER} \left( \frac{REER_{it} - REER_{it-1}}{REER_{it-1}} \right) + \omega_{r} \left( r_{it} - r_{it-1} \right) + \omega_{RES} \left( \frac{RES_{it} - RES_{it-1}}{RES_{it-1}} \right) \]

The independent variables used in this study are: Loan to Asset Ratio (LAR) for conventional and Financing to Asset Ratio (FAR) for sharia, CAR (Capital Adequacy Ratio), Inflation (INFL), BI Rate (NTR), Product Industry Index (IPI), Export Growth (EXPG), M2 Ratio to Foreign Exchange Reserves (M2RES), Real Exchange Rate (REER), Bank Indonesia Certificates (SBI) and Bank Indonesia Syariah Certificates (SBIS).

**Data Processing Methods**

As in linear regression, the general model of multiple logistic regression (Logit) is a multiple regression model, a model that involves more than one predictor / independent variable. The logit model is simply defined as a non-linear regression model that produces equations in which the dependent variable is categorical. The most basic category of the model produces binary values such as numbers 0 and 1. This number represents a particular category resulting from calculating the probability of the occurrence of that category (Winarno, 2009).

Gujarati (2003) states that the logit model is often used in classification data. The logit model approach is used because it can explain the relationship between x and p (x) which is not linear, the distribution abnormalities of Y, and the variability of non-constant responses that cannot be explained by ordinary linear models.

The regression equation for the logit model is obtained from the decrease in the probability equation of the categories to be estimated. The probability equation is:

\[ P_i = E(Y = 1) | X_i = \frac{1}{1 + e^{-\left( \beta_1 + \beta_2 X_{i2} \right)}} \]  

(3.1)

This equation can be simplified by assuming \((\beta_1 + \beta_2 X_{i2}) = Z_i\), resulting in the following equation:

\[ P_i = \frac{1}{1 + e^{-Z_i}} = \frac{e^Z}{1 + e^Z} \]  

(3.2)

In equation (3.2), it can be seen that \(Z_i\) is in the range \(-\infty\) to \(+\infty\) and \(P_i\) is in the range 0 to 1 where \(P_i\) has a nonlinear relationship to \(Z_i\).

The nonlinearity in \(P_i\) is not only towards X, but also towards \(\beta\). This raises the problem of estimation so that the ordinary least square (OLS) regression procedure cannot be performed. The solution to this problem is to direct equation (3.1) by applying natural logarithms to category 0 as in the following equation:

\[ 1 - P_i = \frac{1}{1 + e^{-Z_i}} \]  

(3.3)

This equation can be substituted by equation (3.2) to be:

\[ \frac{P_i}{1-P_i} = \frac{1 + e^{-Z_i}}{1 + e^{-Z_i}} \]  

(3.4)

The equation \(\frac{P_i}{1-P_i}\) is also called the odds ratio for the occurrence of a category with a value of 1, in this case a crisis occurs. If \(P_i\) is 0.9, the tendency for a
currency crisis to be even greater. The closer the value to 1, the greater the tendency for a crisis to occur.

In research that uses logistic regression analysis, there are several tests that must be passed, including: Hosmer and Lemeshow Goodness of Fit, Partial Significance Test, Multicollinearity and the Coefficient of Determination Test.

RESULT AND DISCUSSION

Data Profiles

The data used in this study is the value of Crisis Severe Distress (CSD) which is obtained from the EMPI value with the criteria if the EMPI value exceeds two standard deviations plus the average means crisis (1) and if it is less than twice the standard deviation is added an average the average is not a crisis (0). Other data are liquidity ratios (LAR and FAR), solvency ratios (VARK and CARS), interest rates or BI Rate (INTR), inflation rates (INFL), national income growth proxied by the growth of the Industrial Product Index (IPIG), and Export growth (EXPG) from January 2004 to April 2017.

Crisis Period in Indonesia

Based on calculations, the crisis periods experienced by Indonesia occurred in August 2005, October 2008, and November 2008. To check whether the determination of this crisis period is in accordance with what has happened in the real world, a historical review will be carried out for each crisis period. the. Based on the EMPI calculation, the tresshold between a crisis and a non-crisis is 0.59. In August 2005 the EMPI value was 0.89. During this period the rupiah exchange rate weakened so that the rupiah went through more than Rp. 12,000 / USD (October 2008). This shows the real exchange rate is overvalued, which has an impact on increasing the probability of the financial crisis as well as weakening competitiveness in the international market which can also be seen from the slowdown in export growth which decreased by 12%. Foreign exchange reserves also decreased by USD 6,199 or around 7%.

Statistical Analysis of Conventional Models

a. Assessing the Overall Model (Overall Fit Model)

The first step is to assess the overall fit of the model against the data. The decision making criterion is to reject $H_0$ if the value of $-2 \text{Log Likelihood} > \text{Chi Square table at degrees of freedom (df)} = N-1$, $N$ is the number of parameters in the model. The confidence level used by the author in this study was 90% or in other words, the significance level of $x$ was 10%.

The value of $-2 \text{Log Likelihood}$ on the Beginning Block which is compared with the Chi Square value in the table with df of N - 1 = 88 - 1 = 87 at the significance level of 0.1 shows that $-2 \text{Log Likelihood} < \text{Chi Square table}. This means that the decision taken is to accept $H_0$ which indicates that in the four conventional models there is no significant difference between the model and the constant. Value $-2 \text{Log Likelihood} < \text{Chi Square table}$. This shows that the model that includes independent variables is fit with the data, so it is feasible to use.

b. Hosmer and Lemeshow Goodness of Fit Test

The Hosmer and Lemeshow Goodness of Fit Test aims to see whether the empirical data fits the model (there is no difference between the model and the data so that the model can be said to be fit). Based on the results of the calculation, it appears that the significance values of 1,000 and 0.996 are greater than 0.1 which indicates that the four models are acceptable and hypothesis testing can be carried out.

Table 2: Hosmer and Lemeshow Goodness of Fit Test Results

<table>
<thead>
<tr>
<th>Model</th>
<th>Hosmer &amp; Lemeshow</th>
<th>Sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td>0.604</td>
<td>1</td>
</tr>
<tr>
<td>Model 2</td>
<td>0.512</td>
<td>1</td>
</tr>
<tr>
<td>Model 3</td>
<td>0.222</td>
<td>1</td>
</tr>
<tr>
<td>Model 4</td>
<td>1.260</td>
<td>0.996</td>
</tr>
</tbody>
</table>

c. Determination Coefficient Test

To see the ability of the independent variable in explaining the Crisis Severe Distress variance, the Cox & Snell R Square and Nagelkerke R Square values were used. The Nagelkerke R Square value, which is greater than Cox & Snell R Square, indicates the ability of the five independent variables to explain the Crisis Severe Distress variance and the rest there are other factors that explain CSD variance.
From the four models above, it can be concluded that the Nagelkerke R Square value which is between 0.577 to 0.675 indicates the ability of each independent variable in explaining Crisis Severe Distress variance and the rest there are other factors outside the model. Another better calculation to find out how well the independent variables explain the dependent variable is by looking at the value of the overall percentage, which is the ratio between the number of correct predictions and the total number of observations in the Classification Table. The correct number of observations is when there is a warning of a crisis followed by a crisis and when there is no warning of a crisis followed by a non-occurrence of a crisis.

Table 4: Model Fitting Test Results

<table>
<thead>
<tr>
<th>Model Precision</th>
<th>B/A+B</th>
<th>C/C+D</th>
<th>D/A+B+C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td>98.8</td>
<td>66.7</td>
<td>97.7</td>
</tr>
<tr>
<td>Model 2</td>
<td>98.8</td>
<td>66.7</td>
<td>97.7</td>
</tr>
<tr>
<td>Model 3</td>
<td>98.8</td>
<td>66.7</td>
<td>97.7</td>
</tr>
<tr>
<td>Model 4</td>
<td>98.8</td>
<td>33.3</td>
<td>96.6</td>
</tr>
</tbody>
</table>

* Bold mark shows the overall percentage value

In the first model, based on the estimation results, the sample that did not experience a crisis (0) was 85 periods. The results of the model prediction in the table above are 84 periods where there was no crisis (0) and 1 period when there was a crisis. It means that there is 1 wrong prediction so that the correct prediction is as much as 84/85 = 98.8%. Meanwhile, for the period of crisis (1) out of 3 samples, only 1 period was predicted to be inappropriate by the research model so that the correctness of the model for the period of the crisis was 2/3 = 66.7%. Thus the first model gives an overall percentage value of (84 + 2) / 88 = 97.7%, which means that the accuracy of this research model is 97.7%. Likewise, models 2, 3 and 4, respectively, have an overall percentage value in the range of 97.7% and 96.6%.

**d. Multicollinearity Test**

Multicollinearity in SPSS devices can be seen with the VIF, Tolerance, and correlation matrix commands. In the logit regression results in this study, it was concluded that there was no multicollinearity between variables. Variables that cause multicollinearity can be seen from a tolerance value that is smaller than 0.1 or a VIF value greater than the value of 10. This is also supported by a value of 1/VIF that is not less than 0.1. Based on the calculation results, the VIF value of each variable does not exceed the number 10, this is reinforced by the 1/VIF and Tolerance values which are more than 0.1. So, it can be concluded that the four models do not have multicollinearity disorders.

**Sharia Model Statistical Analysis**

**a. Assessing the Overall Model (Overall Fit Model)**

The first step is to assess the overall fit of the model against the data. For the sharia model, the value of -2 Log Likelihood on the Beginning Block is 26.169 in the 6th iteration. This value is the Chi Square value compared to the Chi Square value in the table with a df of N - 1 = 88 - 1 = 87 at a significance level of 0.1, which is 104.750, it appears that -2 Log Likelihood <Chi Square table (26.169 <104.750). This means that the decision taken is to accept H0 which indicates that there is no significant difference between the model and the constant.

Table 5: Model Fit Test

<table>
<thead>
<tr>
<th>Iteration History</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iteration</td>
</tr>
<tr>
<td>Step 0</td>
</tr>
<tr>
<td>Step 1</td>
</tr>
</tbody>
</table>

Not different from the conventional model, the overall assessment of the model for sharia is -2 Log Likelihood <Chi Square table which shows that the model that includes independent variables is fit with the data. This shows that the model is feasible to use.

**b. Hosmer and Lemeshow Goodness of Fit Test**

Furthermore, to see whether the empirical data fits the model (there is no difference between the model and the data), it is done by looking at the Hosmer and Lemeshow Test values, which are as follows:

Table 6: Results of the Sharia Model Goodness of Fit Test

<table>
<thead>
<tr>
<th>Hosmer &amp; Lemeshow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chi Square</td>
</tr>
<tr>
<td>Model 1</td>
</tr>
<tr>
<td>Model 2</td>
</tr>
<tr>
<td>Model 3</td>
</tr>
<tr>
<td>Model 4</td>
</tr>
</tbody>
</table>

Based on the calculation results, it appears that the four sharia models are at a significance level of 0.1, the Chi Square value is calculated <Chi Square table. It can also be seen that the significance value of 0.996 to 1.000 is greater than 0.1 which indicates that the four models are acceptable and hypothesis testing can be done.

**c. Determination Coefficient Test**

To see the ability of the independent variable in explaining the variance of crisis severe distress, the values of Cox & Snell R Square and Nagelkerke R...
Square are used. The Nagelkerke R Square value, which is greater than Cox & Snell R Square, indicates the ability of the five independent variables to explain the Crisis Severe Distress variance and the rest there are other factors that explain CSD variance.

Table 7: Results of the Sharia Model Determination Coefficient Test

<table>
<thead>
<tr>
<th></th>
<th>Determination Coefficient</th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Cox &amp; Snell</td>
<td>Nagelkerke</td>
</tr>
<tr>
<td>Model 1</td>
<td>0.149</td>
<td>0.577</td>
</tr>
<tr>
<td>Model 2</td>
<td>0.174</td>
<td>0.678</td>
</tr>
<tr>
<td>Model 3</td>
<td>0.157</td>
<td>0.519</td>
</tr>
<tr>
<td>Model 4</td>
<td>0.169</td>
<td>0.457</td>
</tr>
</tbody>
</table>

If you look at the test results of the four models above, it can be concluded that the Nagelkerke R Square value which is between 0.577 to 0.678 indicates the ability of each independent variable to explain the Crisis Severe Distress variance and the rest there are other factors outside the model.

Another better calculation to find out how well the independent variables explain the dependent variable is by looking at the value of the overall percentage, which is the ratio between the number of correct predictions and the total number of observations in the Classification Table.

Table 8: Model Fitting Test Results

<table>
<thead>
<tr>
<th></th>
<th>Model Precision</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B/A+B</td>
<td>C/C=D</td>
</tr>
<tr>
<td>Model 1</td>
<td>98.8</td>
<td>66.7</td>
</tr>
<tr>
<td>Model 2</td>
<td>100</td>
<td>66.7</td>
</tr>
<tr>
<td>Model 3</td>
<td>98.8</td>
<td>33.3</td>
</tr>
<tr>
<td>Model 4</td>
<td>98.8</td>
<td>33.3</td>
</tr>
</tbody>
</table>

* Bold mark shows the overall percentage value

In the first model, the sample that did not experience a crisis (0) was 85 periods. The results of the model prediction in the table above are 84 periods where there was no crisis (0) and 1 period when there was a crisis. It means that there is 1 wrong prediction so that the correct prediction is as much as 84/85 = 98.8%. Meanwhile, for the period of crisis (1) out of 3 samples, only 1 period was predicted to be inappropriate by the research model so that the correctness of the model for the period of the crisis was 2/3 = 66.7%. Thus the table above gives an overall percentage value of (84 + 2) / 88 = 97.7%, which means the accuracy of this research model is 97.7%. The models 2 to 4 are 98.9, 96.6 and 96.6 percent, respectively.

d. Multicollinearity Test

In the logistic regression results in this study, it was concluded that there was no multicollinearity between variables. Variables that cause multicollinearity can be seen from a tolerance value that is less than 0.1 or a VIF value greater than the value of 10. This is also supported by a 1 / VIF value that is not less than 0.1 or the level of confidence used. The VIF value of each variable does not exceed 10, this is reinforced by the 1 / VIF and Tolerance values which are more than 0.1. So it can be concluded that the four sharia models do not have multicollinearity disorders.

e. Partial Significance Test of Sharia and Conventional Models

The partial significance test aims to see the significance of an independent variable in influencing the dependent variable in an equation. This test is done by looking at the significance of each parameter of the variable. In summary, the econometric indicators for each model can be seen in Table 9 in Appendix.

The best model produced from the four models is the first model because it has significantly more independent variables than the other models, while for statistical tests, the four models have met the eligibility requirements of the model. So that the resulting equation is as follows:

- Logistic Regression Equation for conventional banking

\[
CSD = 100,502 - 0,646 LARK - 4,254 CARK + 0,014 INFL + 0,893 INTR + 0,108 IPIG
\]

- Logistic Regression Equations for Islamic banking

\[
CSD = -172,719 + 2,115 FAR + 0,161 CARS - 4,956 INFL + 0,069 INTR + 0,123 IPIG
\]

In summary, the interpretation of each independent variable produced in this paper can be seen in the following Table 10 in Appendix.

CONCLUSION

This research on the early detection system for crises in the dual banking system in Indonesia has produced several important conclusions, namely:

1. Based on the estimation results, several variables that can be used as early indicators of the financial crisis for the conventional banking industry are the Capital Adequacy Ratio (CARK) and the interest rate (INTR) variable. This conclusion is in line with what Barrell et al. (2010), Boyd et al. (2009), Kunt (2005) and Hardy and Pazarpasuloglu (1998). Meanwhile, for the prediction of early detection of financial crises for the Islamic banking industry, only the FAR (Financing to Asset Ratio) variable has a significance above 90%. This is similar to the results of research by Hadad et al. (2003) which mentions the intensive credit variable from the banking system as an indicator of the banking crisis early warning system.

2. If you see the coefficient sign, the variable Capital Adequacy Ratio or capital adequacy ratio (CARK) has a negative sign. This means that there is an
Some of the recommendations that the author can give regarding research on the Early Warning System in the dual banking system in Indonesia include:

1. The calculation results show that the CAR variable (capital adequacy ratio) and the macro variable of interest rates are indicated to be early indicators of financial crisis in the conventional banking sector. Therefore, it really needs to be paid attention by stakeholders, both from banks and monetary authorities.

2. On the Islamic banking side, the FAR (Financing to Asset Ratio) variable is an early indicator of the financial crisis. Therefore, this side (as a reflection of liquidity) deserves to be the main concern of Islamic banking stakeholders in Indonesia.

3. No less important, this study also proves that the conventional banking industry is more susceptible to crisis impacts than Islamic banking, especially due to the shock of macroeconomic variables. Thus, it becomes a rational reason for the monetary authority, in this case Bank Indonesia, to provide more support for the sustainability of Islamic finance and banking in Indonesia.

4. The government is expected to have a good economic recording system - both micro and macro - so that important indicators can be used consistently to predict future crises.

5. This paper has many shortcomings, including: the need for a longer data series in research observations, or the use of other methodologies, for example the modification of the multinomial logit method. So that the results obtained are more precise in measuring early detection of the financial crisis in Indonesia.

REFERENCES


APPENDIX

Table 1. Research Model Equations

<table>
<thead>
<tr>
<th>Model</th>
<th>Variabel</th>
<th>Sign.</th>
<th>Overall test</th>
<th>Hosmer &amp; Lemeshow</th>
<th>Koef Determinasi</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Chi Square</td>
<td>Sign</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Chi Square</td>
<td>Sign</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Chi Square</td>
<td>Sign</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Chi Square</td>
<td>Sign</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
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<td>Model 1</td>
<td>CSD = α_1 + α_2 LAR + α_3 CARK + α_4 INFL + α_5 INTR + α_6 IP+G + u_i</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 2</td>
<td>CSD = β_1 + β_2 FAR + β_3 CARS + β_4 INFL + β_5 INTR + β_6 IP+G + u_i</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 3</td>
<td>CSD = α_1 + α_2 LAR + α_3 CARK + α_4 INFL + α_5 INTR + α_6 EXPG + u_i</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 4</td>
<td>CSD = α_1 + α_2 LAR + α_3 CARK + α_4 INFL + α_5 INTR + α_6 IP+G + u_i</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 9. Summary of Overall Significance Test Results

<table>
<thead>
<tr>
<th>Model</th>
<th>Variabel</th>
<th>Sign.</th>
<th>Overall test</th>
<th>Hosmer &amp; Lemeshow</th>
<th>Koef Determinasi</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>Sign</td>
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<td>Sign</td>
<td></td>
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<td></td>
<td>Chi Square</td>
<td>Sign</td>
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<td>LAR</td>
<td>0.153</td>
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<td>C</td>
<td>0.109</td>
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<td>0.015</td>
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<td></td>
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<td></td>
<td>INFL</td>
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<td></td>
<td>INTR</td>
<td>0.902</td>
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<td>IP+G</td>
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<td>C</td>
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<tr>
<td></td>
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### Table 10. Interpretation of Each Variable

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coeff Value</th>
<th>Odds ratio</th>
<th>Coeff Mark</th>
<th>Conformity Theory</th>
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</thead>
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<td>CARK</td>
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<td>0.014</td>
<td>Negative</td>
<td>Appropriate</td>
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<td>INTR</td>
<td>0.767</td>
<td>2.443</td>
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<td>Appropriate</td>
</tr>
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<td>FAR</td>
<td>2.115</td>
<td>8.287</td>
<td>Positive</td>
<td>Appropriate</td>
</tr>
<tr>
<td>M2RES</td>
<td>0.4</td>
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<td>Positive</td>
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